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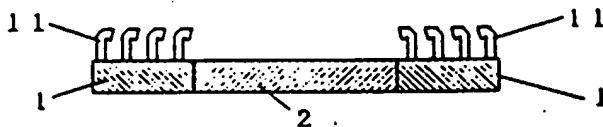
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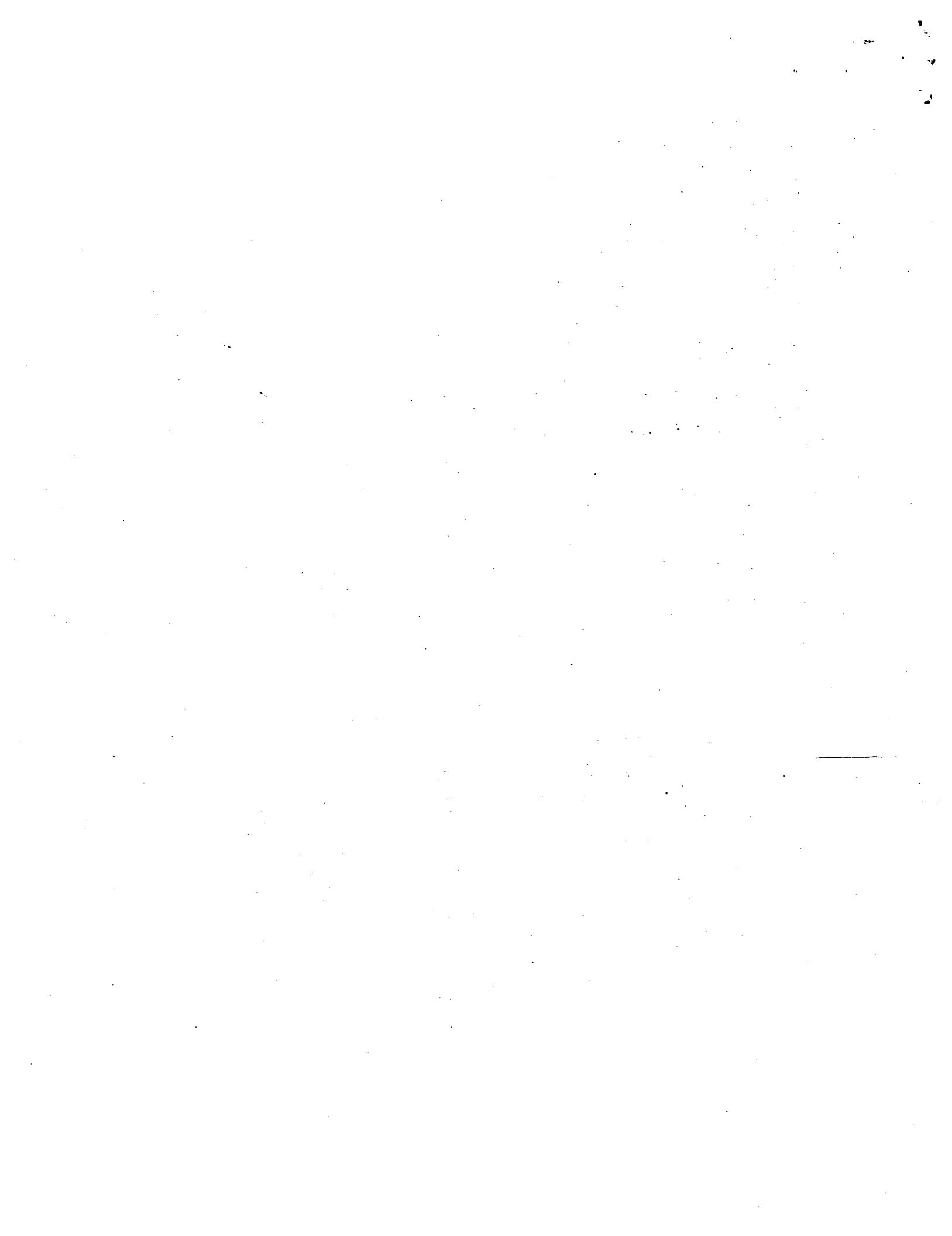
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(54) [Title of the invention] Fastener

(57) [Summary]

[Objective] To obtain a fastener showing good properties of fastening, fixing, reusing and would not cause damages to the objects to be fastened, having appropriate holding capability and excellent in mass production, for fastening end of rolls of rough surface materials such as fabrics and non-woven fabrics, and for fixing such as bandage and paper diapers.





**[Structure]**

Fastener which has fastening sections (1) made of hard plastics on the both ends of an elastic section (2) comprised of thermo-plastic elastomer having rubber elasticity as a single unit, and has hooking sections comprised of multiple numbers of protrusions (11) on one side and the same side of the fastening sections.

**[Patent Claims]**

**[Claim 1]** Fastener which is characterized by having fastening sections made of hard plastics on the both ends of an elastic section comprised of thermo-plastic elastomer having rubber elasticity as a single unit, and having hooking sections comprised of multiple numbers of protrusions on one side and the same side of the fastening sections.

**[Claim 2]** Fastener which is described in the claim 1 and having a holding layer which bonds with the said hooking sections on the back side of the fastening sections that have hooking sections.

**[Claim 3]** Fastener which is described in the claim 1 or 2 and the fastening sections of it having the hooking sections are comprised with a strong plastics layer, and having a plastics layer which has good adhesion to adhesives on the back side of the fastening sections that have hooking sections.

**[Detail explanation of the invention]**

**[0001]**

**[Application field in the industry]** This invention is related with a fastener which is convenient for fastening end of rolls of such as fabrics and non-woven fabrics, and for fixing such as bandage and paper diapers.

**[0002]**

**[Prior art]** Currently, pressure sensitive tapes and magic tape\* have been known as fasteners. However, the pressure sensitive tape is not suitable for adhering to materials with rough surface such as fabrics and non-woven fabrics which tends to be detached when it is used to hold the end of rolls, and also it had a problem that the pressure sensitive adhesive would be transferred to such as the fabric. Further, in case of such as paper diapers, there has been a problem that adhesion is easily lost if handled by hands that have used cream or ointment as the cream or ointment would migrate to the adhesion surface. There has been a proposal of paper diaper using the magic tape\* however it has a difficulty that the adjustment and control is difficult to fix in appropriate condition of tightness that it would not to restrict the motion of a baby and would not peel off by the motion of a baby.

*Translator's note: "Magic tape" is a common name for "Velcro" type tape in Japan which does not mean "Magic Mending tape".*

[0003] On the other hand, for such as fixing bandages, flat rubber band attached with fastening metal pieces and nets have been known. However, with the flat rubber band attached with fastening metal pieces easily cause damages due to the holes caused by the fastening metal pieces, and the net has poor holding which would make the bandage loose due to the motion. Tapes for holding bandages are also known, however, it is poor at adhesion as the said adhesive tape and the bandage would get loose due to the motion and has a drawback that it accompanies a pain in skin when removing it.

[0004]

**[Problems that the invention is to solve]** The objective of this invention is to develop a fastener showing a good binding or binding capability, an ability for repeated use and an ability not to cause damages to the objects to be fastened, having appropriate tightening capability in such as holding end of rolls of rough surface materials such as fabrics and non woven fabrics and in fixing such as bandages paper diapers, and is good in mass production capability.

[0005]

**[Means to solve the problems]** This invention is to provide a fastener which has fastening sections made of hard plastics on the both ends of an elastic section comprised of thermo-plastic elastomer having rubber elasticity as a single unit, and has hooking sections comprised of multiple numbers of protrusions on one side and the same side of the fastening sections.

[0006]

**[Function]** Thanks to the said structure which is constructed by providing the fastening sections on the both sides of the elastic section in the middle in a single unit, it is able to provide appropriate tightening capability and good tying or fixing capability, based on such as the smooth transmission capability of the stress at the elastic section to the fastening sections. Also, by forming the fastening sections with multiple protrusions made of hard plastics, it is able to provide a good reusability and the capability not to damage the objects to be fastened.

[0007]

**[Execution examples]** The fastener of this invention comprises of having fastening sections made of hard plastics on the both ends of an elastic section comprised of thermo-plastic elastomer having rubber elasticity as a single unit, and having hooking sections comprised of multiple numbers of protrusions on one side

) and the same side of the fastening sections. Its examples are shown in Figure 1 and Figure 3 through Figure 5. 1 is the fastening section, 2 is the elastic section and 11 is the protrusion that forms the hooking section.

[0008] As for the thermoplastic elastomer having rubber elasticity that forms the elastic section, it is able to use one having appropriate elasticity depending on such as desired tightening force. As for the examples of the thermoplastic elastomers, such as polyurethane elastomer, polyolefin elastomer, polystyrene elastomer, soft polyvinyl chloride, and several types of rubber polymers may be listed which are described in the patent publication Shou 63-86784, patent publication Shou 63-142086, and utility right publication Hei 1-130359.

[0009] The elastic section is normally formed in sheet shape or tape shape. Its size is appropriately determined depending on such as the purpose of its use. From the handling and ease of production or fabrication standpoints, its thickness is preferable to be 1 mm or less, especially 0.01 to 0.5 mm, and more preferably 0.05 to 0.2 mm. And its width is preferred to be 1 to 200 mm, especially 5 to 100 mm and more preferably 10 to 20 mm is common. The elasticity of the elastic section may be controlled by its dimensional control such as thickness, width and length as well as controlling the elasticity of the said material.

[0010] The fastening sections are formed on the both side having the elastic section between them using hard plastics as a single unit with the elastic section. As for the hard plastics, appropriate ones may be used and as for the examples of them, such as polyethylene, polypropylene, polystyrene, polyester, ABS resin, polycarbonate, polyamide, polyacetal, PBT, and PPS may be listed.

[0011] The forming of the elastic section and the fastening section in a single unit may be done by such as co-extrusion forming, for example. Therefore, the combination of the thermoplastic elastomer for forming the elastic section and the hard plastics for forming the fastening sections is appropriately determined from the standpoint of such as the boundary adhesion between the elastic section and the fixing sections, and forming property of especially its fastening sections. As for the preferable combinations from the standpoint such as forming property, combinations of such as ethylene-propylene elastomer or ethylene-butylene-styrene elastomer and polypropylene may be listed.

[0012] The hooking sections provided in one side of the fastening sections are formed with multiple number of protrusions. The hooking structure of each protrusion may be made into appropriate structures as shown in the Figures 2(a) through (e) making the tips of the protrusions in hook shapes 12, 13 and 14, or in

mushroom shape 15 and 16, which are able to hook onto fiber or string of rough surface such as fabrics, non-woven fabrics and pile fabrics, or hook between fibers of them. Accordingly, it is able to make the protrusion shape in the shape of magic tapes which have been known to the public.

[0013] The hooking sections are provided on the same side of the fastening sections on the both sides of the elastic section for the ease of handling. If the protrusions have hook shape tips, there is an advantage that the binding force gets stronger because it works to each other when the tips are in uniform direction at each fastening sections as shown in the drawing and they are in a situation that they are facing each other at the fastening sections at the both ends. The direction of the tip of the said protrusions is also related with the releasing property of the fastener, therefore, it should not be limited within the above described uniform and opposing condition in this invention but such as the uniformity at each fastening section and the opposing direction at both ends should be appropriately determined based on such as properties of removing.

[0014] The density of the protrusions at the hooking section of the fastening sections may be appropriately determined based on such as binding force and removal property. Generally, the protrusion density should be no less than 1 for 1 cm<sup>2</sup>, preferably 3 to 1000 and especially 5 to 200.

[0015] The size of the fastening section shall be appropriately determined based on such as the objectives of use, and from the such as handling viewpoint, its thickness is preferable to be 1 mm or less and more preferably 0.01 to 0.5 mm and especially 0.05 to 0.2 mm. Also the height of the protrusions are preferred to be 1 mm or less, more preferably 0.1 to 1.0 mm, and especially 0.4 to 0.6 mm from the standpoint of such as the strength. Its width is generally 1 to 200 mm, preferably 2 to 100 mm and, especially 3 to 50 mm, and its length is generally 5 to 50 mm, preferably 3 to 30 mm and especially 12 to 20 mm. Further, the fastening sections are more preferable if their thickness is thinner as no more than 0.1 mm, for example.

[0016] As for a concrete example of co-extrusion process for forming the said elastic section and fastening sections in a single unit, such as a process to form with a single die using two extruders. Namely, it is able to produce it in continuous sheet form by connecting nozzles of two extruders to one die and by co-extruding so that thermoplastic elastomer for forming elastic section comes to the middle and hard plastic for forming fastening sections comes to the both sides of it and they merge at the die exit.

[0017] The intended fastener is able to be continuously produced in continuous form by following process; take up the continuous sheet formed in the above described process at the exit of the die with the first take-up roll for cooling by using a roll with many holed provided on a part of its surface as the first take-up roll, press with a press roll so that the molten hard plastics for forming the fastening sections will flow into the holes and cool down, then take up to the second take-up roll from the first take-up roll with following processes to form the tip of the protrusions that have been formed by the holes on the first take-up roll into specific shapes such as hook or mushroom shapes by heat treatment with appropriate heat source such as a heat roll or a hot air dryer. The fastener is provided by cutting the continuous sheet in specified width.

[0018] In this invention, as shown in the Figures 3 and 5 as examples, it is able to make as fastening device that has holding layers 3 and 6 which couples with the fastening sections on the backside of the said fastening sections 1 having the hooking sections. According to this, it is able to form a ring shape object by coupling the hooking section of one side of the fastening sections with the holding layer of the other side of the fastening sections, and use it as a tying device for rod or wire materials. As for the holding layer, it is able to use rough surface materials such as fabrics, non-woven fabrics and piled cloth.

[0019] The holding layer may be adhered in appropriate adhesion system such as directly on the backside of the fastening sections 1 as shown in the figure 3, or adhered on the backside of the fastening sections 1 with adhesive between them as shown in the Figure 5. For example the said direct adhesion may be done by introducing material that forms the holding layer between the first take-up roll and the press roll to execute lamination at compressing process by press rolls during the above described protrusion forming process. The adhesion process using adhesive may be done at any appropriate process steps.

[0020] In the above described process, it is preferable to form the fastening sections 1 having hooking sections with hard and strong plastics layer and to provide a plastic layer which well adheres to adhesives on the backside of the fastening sections 1 as shown in the figure 4 from the standpoint of such as improvement of durability by adhesion treating the holding layer with a good contact. Accordingly in this case, the holding layer 6 is provided with a plastics layer 4 on the backside of the fastening sections 1, and if adhesive is used, the holding layer is provided on the backside of the fastening sections with the plastics layer 4 and the adhesive layer 5 between them.

[0021] As for the said hard and strong plastics that forms the fastening sections, such as polypropylene, polyamide and polyester are listed, for example. On the other hand, as for the plastics with good adhesion, modified polymers or co-polymers of the said hard and strong plastics, or polymers that are used for adhesives such as ethylene-vinyl acetate co-polymer are preferable for example from the standpoint of such as good adhesion with the said hard and strong plastics.

[0022] It becomes possible to obtain good adhesion to the said good adhesion plastics layer with double coated tapes using appropriate adhesives such as acrylic, rubber, and styrene-isoprene block polymer. Further, the double coated tape that has been adhered to the good adhesion plastics layer may be used for other adhering purposes other then adhering the holding layer.

[0023] Application of the good adhesion plastics layer to the backside of the fastening sections may be formed efficiently by adding one more extruder, which means connecting nozzles of three extruders to one die, to co-extrude so that the hard plastics for forming the fastening sections and the plastics for forming the good adhesion layer merge together in laid over condition, during the said continuous sheet forming by the co-extrusion process. In this case, the hard plastic layer for forming the fastening sections is layer over to come the first take-up roll side which has been formed with multiple number of holes.

[0024] Example 1

Fastener of sheet thickness 0.1 mm was continuously obtained by following process; nozzles of two injection molding machines were connected to a single die, using a co-extrusion process in which thermoplastic elastomer for forming elastic section comes to the center and hard plastics for forming fastening sections comes to the both sides of it and they merge together and connecting, a continuous sheet that has polypropylene sections on the both sides of ethylene-propylene elastomer was formed, it was taken up at the die exit with the first take-up roll for cooling provided with multiple number of holes of 0.5 mm diameter, 1 mm depth and 1 mm pitch formed to respond to the polypropylene sections, and it was simultaneously compressed and cooled down with a press roll, then while taking up with the second take-up roll the tips of the protrusions formed on the sheet was made to instantly contact with a hot plate at 150 to 160 °C then immediately cooled down to under 100 °C to form protrusions of about 0.6 mm tall with their tips bent in hook shape, and the continuous sheet was cut into 30 mm wide.

[0025] When the said fastener was used as roll end holder for holding fabric roll end, it was able to hold the roll well, and even the eleventh time of the end holding

and removing were done well after repeating the actions of the end holding and removing for 10 times. Also, damages such as breakage of the fabric was not found by visually inspection after the removing.

[0026] Example 2

A fastener was obtained as same as the Example 1 except for inserting face towel between the first take-up roll and the press roll and laminating it which is in corresponding width with the polypropylene sections to be located on the backside of the polypropylene sections, when pressing with the press roll.

[0027] The said fastener was used as a tie for pipes or electric cables, and it was able to tie in a good condition without causing falling apart. Further, it was able to do the eleventh tying and untying in good conditions after repeating tying and untying for ten times.

[0028] Example 3

Continuous sheet in fastener shape was obtained as same as the Example 1 except for forming the continuous sheet by connecting nozzles of three extruders to one die and co-extruding so that polypropylene part and ethylene-vinyl acetate copolymer part merge in overlaid each other at the die exit. Further, the thickness of the polypropylene layer and the ethylene-vinyl acetate copolymer layer were in the same thickness.

[0029] Then face towel fabric was laminated to ethylene-vinyl acetate copolymer surface of the said continuous sheet with acrylic double coated tape, and it was cut as same as the Example 1 to obtain a fastener. The said fastener was used as a tie for pipes or electric cables, and the result was as good as the case of the Example 2.

[0030]

**[Effect of invention]** According to this invention, it is able to obtain fasteners which show good properties of fastening, fixing, reusing and no destruction against objects to be fastened, having appropriate holding capability with elasticity and excellent in mass production, and are able to be widely used for such as fastening end of rolls of rough surface material such as fabrics and non-woven fabrics and for fixing bandage and paper diapers.

**[Brief explanation of drawings]**

[Figure 1] cross sectional drawing of an Example

[Figure 2] explanation drawing for example shapes of protrusions

[Figure 3] cross sectional drawing of another Example

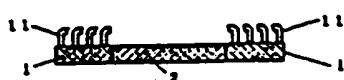
[Figure 4] cross sectional drawing of other Example

[Figure 5] cross sectional drawing of other Example

[Explanation of symbols]

- 1: fastening section
- 11, 12, 13, 14, 15, 16: protrusions
- 2: elastic section
- 3, 6: holding layer
- 4: plastics layer having good adhesion to adhesives
- 5: adhesive layer

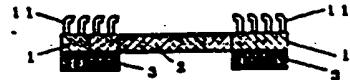
[Figure 1]



[Figure 2]



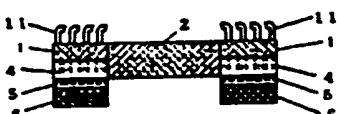
[Figure 3]



[Figure 4]



[Figure 5]



Translated by Hideyo Sugimura, 704-3102, Sunday, November 24, 1996